SEMESTER END EXAMINATION, MAY, 2024

Course Name: - B.Tech **Semester:-4th**

Paper Name: - Design and analysis of algorithm **Paper Code:- TCS 402**

Time - 3 Hrs + 20 minutes per hour extra time for V.I. & examinees with writer. **Max Marks-70**

समय– 3 घण्टे + 20 मिनट प्रति घंटे अतिरिक्त–दृष्टिबाधित एवं साह लेखक परीक्षार्थियों के लिए। अधिकतम अंक–70

Instructions:

- The question paper consists of three sections namely A, B, C. All sections are compulsory.
- Section A- Each question carries **3 mark. All questions are compulsory.**
- Section B- Answer any **5 out of 7** given questions in maximum one hundred fifty (150) words. Each question carries **7 marks.**
- Section C- Answer any **2 out of 3** given questions in maximum three hundred (300) words. Each question carries **10 marks.**

निर्देश:

- प्रश्न पत्र में तीन खण्ड अ, ब, व स हैं। सभी खण्ड अनिवार्य हैं।
- खण्ड–अ में प्रत्येक प्रश्न **तीन अंक** का है। **सभी प्रश्न अनिवार्य हैं।**
- खण्ड–ब में **सात प्रश्नों में से किन्हीं पाँच** प्रश्नों के उत्तर अधिकतम 150 शब्दों में दें। प्रत्येक प्रश्न **सात अंक** का है।
- खण्ड–स में **तीन प्रश्नों में से किन्हीं दो** प्रश्नों के उत्तर अधिकतम (250-300) शब्दों में दें। प्रत्येक प्रश्न **10 अंक** का है।

Section – A (खण्ड–अ)

Objective Questions(वस्तुनिष्ठ प्रश्न)

1. Answer all the following questions. **5x3 =15**

निम्नलिखित सभी प्रश्न अनिवार्य हैं।

i) **Which algorithm is used to solve the Travelling Salesman Problem (TSP) in polynomial time, assuming P = NP?**

A) Dijkstra's algorithm
B) Bellman-Ford algorithm
C) No polynomial-time algorithm exists for TSP assuming $P \neq NP$ ✓
D) Kruskal's algorithm

ii) **Which algorithm is used to find the Minimum Spanning Tree (MST) of a connected, undirected graph by adding the shortest edges one at a time, ensuring no cycles are formed?**

A) Prim's algorithm
B) Kruskal's algorithm
C) Dijkstra's algorithm
D) Bellman-Ford algorithm

iii) **Prim's algorithm for finding the Minimum Spanning Tree (MST) of a graph is similar to which other algorithm?**

A) Dijkstra's algorithm
B) Huffman coding
C) Bellman-Ford algorithm
D) Travelling Salesman Problem (TSP)

iv) **Huffman coding is primarily used for which of the following purposes?**

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A) Finding the shortest path in a graph
B) Constructing a Minimum Spanning Tree
C) Data compression
D) Solving the Travelling Salesman Problem

v) **Dijkstra's algorithm is used for which of the following purposes?**
A) Finding the shortest path from a single source to all other vertices in a graph with non-negative edge weights
B) Finding the Minimum Spanning Tree
C) Solving the Travelling Salesman Problem
D) Encoding data for compression

Section – B (खण्ड–ब)
Short Answer Questions (लघुउत्तरीय प्रश्न)

2. Answer any five of the following questions in maximum 150 words. **5x7=35**
निम्नलिखित में से किन्हीं पाँच प्रश्नों के उत्तर अधिकतम 150 शब्दों में दें।

i. What is the Master Theorem used for? What are the three cases of the Master Theorem? Solve the recurrence relation using master theorem

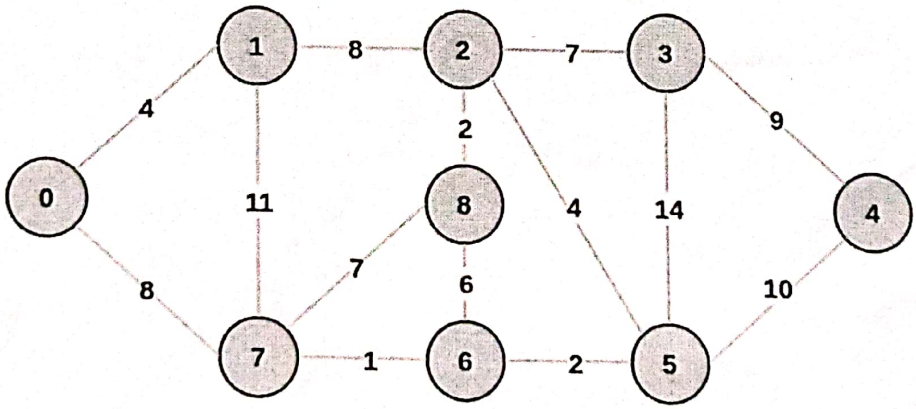
$T(n)= 2T(n/2)+n^2$

ii. How can you find the maximum and minimum element in an array (10,20,30,1,2,3,11,21,31) using Divide and Conquer ? Write its recurrence relations and solve it.

iii. How can you efficiently calculate the power of a number ?Write the recurrence relation to calculate the power of a number?

iv. What is Huffman coding used for?What data structure is used to build the Huffman tree? Solve this using Huffman coding (a=55,b=2,c=9,d=30,e=3,f=1),calculate total number of bits and average bits per character required for encoding where total number of character is 100.

v. How does Prim's algorithm start the MST construction? What is the time complexity of Prim's algorithm using a binary heap.How does Prim's algorithm differ from Kruskal's algorithm?



vi. Solve the above graph using Kruskal algorithm, calculate the minimum cost spanning tree.

vii. Can Dijkstra's algorithm handle graphs with negative edge cycle? Solve it using Bellman Ford algorithm.

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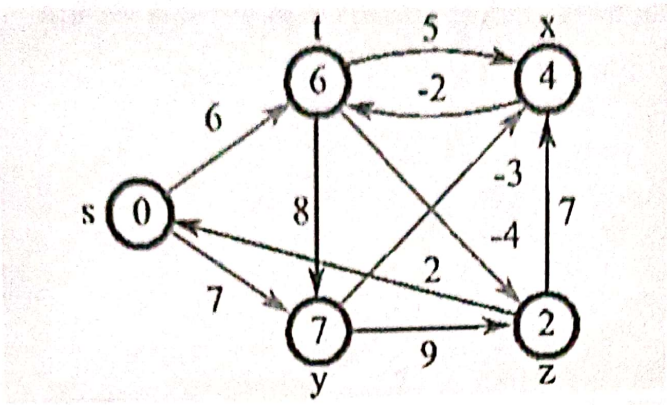
Ford algorithm.



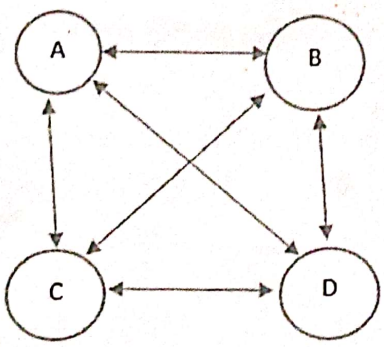
Section – C (खण्ड–स)
Descriptive Questions (विवरणात्मक प्रश्न)

3. Answer any two of the following question in maximum 300 words. **2x10=20**
निम्नलिखित में से किन्हीं दो प्रश्नों के उत्तर अधिकतम 300 शब्दों में दें।

i) Given a sequence of matrices, arr = {40, 20, 30, 10, 30},

find the most efficient way to multiply these matrices together.

ii) Solve the below graph using Travelling salesman ,calculate the total cost.



	A	B	C	D
A	0	4	1	9
B	3	0	6	11
C	4	1	0	2
D	6	5	-4	0

iii) Describe how a quick sort algorithm work with data 2,0,1,7,4,3,5,6. Write quick sort algorithm and partition algorithm .

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